WHAT IS CLAIMED IS:

1. A method for determining a location of a peak of a first correlation function generated by comparing a first image to a second image, at least one of the first and second images acquired such that the image features of that at least one image are smeared, the method comprising:

comparing one of the at least one smeared image to itself at a first plurality of offset positions, the first plurality of offset positions corresponding to a first set of correlation function value points of an auto-correlation function that are distributed around a zero-offset position of that smeared image relative to itself;

analyzing values of the plurality of correlation function value points of the first set to identify at least one width value for a peak portion of the auto-correlation function for the smeared image;

determining at least a smear magnitude based at least partially on the at least one width of the peak portion of the auto-correlation function for the smeared image;

determining, based at least on the determined smear magnitude, at least one potential location of the peak of the first correlation function to a first resolution.

2. The method of claim 1, wherein:

the first and second images can be offset relative to each other along a single dimension that is parallel to an axis of the image; and

comparing the smeared image to itself at the first plurality of offset positions comprises comparing the smeared image to itself at plurality of offset positions that are distributed along the single dimension around the zero-offset position.

3. The method of claim 2, wherein analyzing values of the plurality of correlation function value points of the first set to identify at least one width value comprises identifying a single width value of the peak portion along the single dimension.

4. The method of claim 3, wherein determining at least the smear magnitude comprises determining at least one of a ratio of the single width value to a corresponding width value of the peak of the auto-correlation function for a representative unsmeared image along the single dimension and a difference between the single width value and the corresponding width value.

5. The method of claim 2, wherein determining at least one potential location of the peak of the first correlation function comprises:

determining a smear speed based on the determined smear magnitude and an exposure time of the smeared image;

determining an offset distance based on the smear speed and a time interval between the first image and the second image; and

determining at least one potential peak portion of the first correlation function in a vicinity based on the determined offset distance.

6. The method of claim 5, wherein determining at least one potential peak portion of the first correlation function in a vicinity based on the determined offset distance comprises:

determining a first potential peak portion of the first correlation function offset from the zero offset position of the first image relative to the second image in a first direction along the single dimension; and

determining a second potential peak portion of the first correlation function offset from the zero offset position of the first image relative to the second image in a second direction, opposite the first direction, along the single dimension.

7. The method of claim 5, wherein determining at least one potential peak portion of the first correlation function in a vicinity based on the determined offset distance comprises:

determining a direction of a previously-determined image displacement; and

selecting one of the at least one potential peak portion based on the determined direction.

8. The method of claim 1, wherein:

the first and second images can be offset relative to each other by a vector that can be decomposed into two orthogonal components; and

comparing the smeared image to itself at the first plurality of offset positions comprises comparing the smeared image to itself at plurality of offset positions that are distributed in both of the first dimension and the second dimension around the zero-offset position.

9. The method of claim 8, wherein analyzing values of the plurality of correlation function value points of the first set to identify at least one width value comprises:

identifying a first width value of the peak portion along the first dimension; and

identifying a second width value of the peak portion along the second dimension.

10. The method of claim 9, wherein determining at least the smear magnitude comprises determining a smear magnitude and a smear line direction.

11. The method of claim 10, wherein determining the smear magnitude and line direction comprises:

determining a direction and a length of a maximum length vector combination of the first width value of the peak portion along the first dimension and the second width value of the peak portion along the second dimension; and

determining at least a length of a minimum length vector combination of the first width value of the peak portion along the first dimension and the second width value of the peak portion along the second dimension;

wherein the smear magnitude is the difference between the maximum length vector and the minimum length vector and the smear line direction is the aligned with the direction of the maximum length vector.

12. The method of claim 11, wherein determining at least one potential location of the peak of the first correlation function comprises:

determining a smear speed based on the determined smear magnitude and an exposure time of the smeared image;

determining an offset distance based on the smear speed and a time interval between the first image and the second image; and

determining at least one potential peak portion of the first correlation function based on the determined offset distance along the smear line direction.

13. The method of claim 12, wherein determining at least one potential peak portion of the first correlation function based on the determined offset distance along the smear line direction comprises:

determining a first potential peak portion of the first correlation function offset positively from a zero offset position of the first image relative to the second image along the smear line direction; and

determining a second potential peak portion of the first correlation function offset negatively from a zero offset position of the first image relative to the second image along the smear line direction.

14. The method of claim 8, wherein comparing the smeared image to itself at plurality of offset positions that are distributed in both of the first dimension and the second dimension around the zero-offset position comprises:

comparing the smeared image to itself at plurality of offset positions that are distributed along the first dimension around the zero-offset position with no offset along the second dimension; and.

comparing the smeared image to itself at plurality of offset positions that are distributed along the second dimension around the zero-offset position with no offset along the first dimension.

15. The method of claim 1, further comprising:

comparing the first image to the second image at a second plurality of offset positions, the second plurality of offset positions corresponding to a second set of correlation function value points selected based on the determined at least one potential peak portion; and

determining the location of the peak of the correlation function based on at least some of the second set of correlation function value points.

16. The method of claim 15, further comprising determining a position offset between the first and second images based on the determined location of the peak of the correlation function.

17. The method of claim 1, further comprising:

comparing the first image to the second image at at least one of a second plurality of offset positions, the second plurality of offset positions corresponding to a second set of correlation function value points of the correlation function that are sparsely distributed in at least one potential peak portion of the correlation function, each potential peak portion lying around one of the determined at least one potential location of the peak;

analyzing a value of at least one correlation function value point of the second set to identify at least one correlation function value point of the second set of correlation function value points that lies within a true peak portion of the correlation function;

comparing the first image to the second image at a third plurality of offset positions, the third plurality of offset positions corresponding to a third set of correlation function value points selected based on at least one of the at least one correlation function value point of the second set of correlation function value points that lies within the true peak portion, the third set of correlation function value points densely distributed within at least a region of the true peak portion; and

determining the location of the peak of the correlation function based on at least some of the third set of correlation function value points.

18 The method of claim 17, wherein:

the true peak portion of the correlation function has at least one characteristic extent in a correlation function space; and

determining the second set of correlation function value points comprises selecting the correlation function value points of the second set of correlation function value points such that the location of the correlation function value points of the second set in correlation function space are sparsely distributed throughout the location of the determined at least one potential peak portion of the correlation function in correlation function space such that the correlation function value points within each of the at least one potential peak portion are spaced apart by a distance that is certain to locate at least one of the correlation function value points of the second set within the at least one characteristic extent of the true peak portion of the correlation function in the correlation function space.

19. The method of claim 17, wherein comparing the first image to the second image at at least one of the second set of correlation function value points comprises comparing the first image to the second image to the at least one of the second set of correlation function value points according to an ordered list of the second set of correlation function value points.

20. The method of claim 17, wherein analyzing the value of at least one correlation function value point of the second set comprises comparing the value of

the at least one correlation function value point of the second set to a determined threshold value.

21. The method of claim 17, wherein selecting the third set of correlation function value points based on at least one of the at least one correlation function value point of the second set of correlation function value points that lies within the true peak portion comprises:

identifying one of the at least one correlation function value point of the second set of correlation function value points that lies within the true peak portion that is farthest from an extent for the correlation function values of the correlation function value points that lie outside of the true peak portion; and

selecting a number of contiguous correlation function value points of the correlation function surrounding the identified farthest correlation function value point as the third set of correlation function value points.

22. The method of claim 17, wherein selecting the third set of correlation function value points based on at least one of the at least one correlation function value point of the second set of correlation function value points that lies within the true peak portion comprises:

identifying one of the at least one correlation function value point of the second set of correlation function value points that lies within the true peak portion that is farthest from an extent for the correlation function values of the correlation function value points that lie outside of the true peak portion;

identifying a first one of the second set of correlation function value points that is adjacent to the identified farthest correlation function value point on a first side;

identifying a second one of the second set of correlation function value points that is adjacent to the identified farthest correlation function value point on a second side; and

selecting the correlation function value points of the correlation function that lie between the first and second adjacent correlation function value points as the third set of correlation function value points.

23. The method of claim 17, wherein selecting the third set of correlation function value points based on at least one of the at least one correlation function

value point of the second set of correlation function value points that lies within the true peak portion comprises:

identifying one of the at least one correlation function value point of the second set of correlation function value points that lies within the true peak portion that is farthest from an extent for the correlation function values of the correlation function value points that lie outside of the true peak portion;

identifying a first one of the second set of correlation function value points that is adjacent to the identified farthest correlation function value point on a first side;

identifying a second one of the second set of correlation function value points that is adjacent to the identified farthest correlation function value point on a second side; and

selecting, as the second set of correlation function value points, the correlation function value points of the correlation function that lie within a range of the identified farthest correlation function value point defined based on at least one of the first and second adjacent correlation function value points.

24. The method of claim 17, further comprising determining a position offset between the first and second images based on the determined location of the peak of the correlation function.

25. The method of claim 1, further comprising obtaining the first and second images using an image-correlation optical position transducer having a readhead that is movable relative to a member having an image-determining surface.

26. A recording medium that stores a control program, the control program executable on a computing device usable to receive data corresponding to a first image and a second image suitable for determining a correlation function, at least one of the first and second images acquired such that the image features of that at least one image are smeared, the control program including instructions comprising::

instructions for comparing one of the at least one smeared image to itself at a first plurality of offset positions, the first plurality of offset positions corresponding to a first set of correlation function value points of an auto-correlation function that are distributed around a zero-offset position of that smeared image relative to itself;

instructions for analyzing values of the plurality of correlation function value points of the first set to identify at least one width value for a peak portion of the auto-correlation function for the smeared image;

instructions for determining at least a smear magnitude based at least partially on the at least one width of the peak portion of the auto-correlation function for the smeared image;

instructions for determining, based at least on the determined smear magnitude, at least one potential location of the peak of the first correlation function to a first resolution.

readhead that is movable relative to a member having an image-determining surface.

27. A carrier wave encoded to transmit a control program, the control program executable on a computing device usable to receive data corresponding to a first image and a second image suitable for determining a correlation function, at least one of the first and second images acquired such that the image features of that at least one image are smeared, the control program including instructions comprising::

instructions for comparing one of the at least one smeared image to itself at a first plurality of offset positions, the first plurality of offset positions corresponding to a first set of correlation function value points of an auto-correlation function that are distributed around a zero-offset position of that smeared image relative to itself;

instructions for analyzing values of the plurality of correlation function value points of the first set to identify at least one width value for a peak portion of the auto-correlation function for the smeared image;

instructions for determining at least a smear magnitude based at least partially on the at least one width of the peak portion of the auto-correlation function for the smeared image;

instructions for determining based at least on the determined smear magnitude at least one potential location of the peak of the first correlation function to a first resolution.

28. An image-correlation-based displacement measuring system, usable to measure displacement relative to a member having an image-determining surface, the image-correlation-based displacement measuring system comprising:

a readhead comprising:

a sensing device that receives light reflected from the image-determining surface, the sensing device comprising a plurality of image elements that are sensitive to the reflected light, the plurality of image elements being spaced apart along at least a first direction, the image elements spaced along the first direction at a predetermined spacing, the predetermined spacing usable to determine the spatial translation of an image on the readhead, the spatial translation of the image on the readhead usable to determine the relative displacement of the readhead and the image-determining surface along a predetermined direction, and

a light detector interface circuit connected to the sensing device, the light detector interface circuitry outputting signal values from the image elements of the sensing device, the signal values representative of image intensities of the reflected light on those image elements; and

a signal generating and processing circuitry element connected to the light detector interface circuit of the readhead;

wherein:

the light reflected from the image-determining surface creates an intensity pattern on the plurality of image elements based on the relative position of the image-determining surface and the readhead;

the light detector interface circuitry outputs a signal value from at least some of the plurality of image elements, the signal values together comprising an image;

the signal generating and processing circuitry element inputs a first image corresponding to a first relative position of the image-determining surface and the readhead and stores a representation of the image;

the signal generating and processing circuitry element inputs a second image corresponding to a second relative position of the image-determining surface and the readhead, wherein the signal generating and processing circuitry controls the light detector interface circuit such that at least one of the first and second images is smeared;

the signal generating and processing circuitry element, based on the first and second images, obtains correlation function values for at least one of a first set of correlation function value points that are distributed around a zero-offset

position of an auto-correlation function generated from one of the at least one smeared one of the first and second images;

the signal generating and processing circuitry element analyzes values of at least some of the first set of correlation function value points to determine at least a smear magnitude for the analyzed smeared one of the first and second images;

the signal generating and processing circuitry element, based on the first and second images, obtains correlation function values for at least one of a second set of correlation function value points, the correlation function value points of the second set selected based on the determined at least smear magnitude, the second set of correlation function value points distributed within at least one potential peak portion of the correlation function of the first image relative to the second image; and

the signal generating and processing circuitry element determines the location of the peak of the correlation function based on at least some of the second set of correlation function value points.

29. The image-correlation-based displacement measuring system of claim 28, wherein at least a portion of the signal generating and processing circuitry is included in the readhead.